REMARKS

This is intended as a full and complete response to the Office Action dated November 27, 2006, having a shortened statutory period for response set to expire on February 27, 2007. Please reconsider the claims pending in the application for reasons discussed below.

Claims 1, 3-9, and 11-22 remain pending in the application and are shown above. Claims 1, 3-9, and 11-22 are rejected. Claims 6, 14, and 22 have been cancelled by the Applicants. New claims 23 and 24 have been added. Reconsideration of the rejected claims is requested for reasons presented below.

Claims 1, 9, and 19 are amended to incorporate the subject matter of claims 6, 14, and 22 respectively. Claims 3 and 11 are amended to original scope. Claim 20 has been amended to correct a typographical error. These amendments are not presented to distinguish a reference, thus, the claims as amended are entitled to a full range of equivalents if not previously amended to distinguish a reference.

New claims 23 and 24 have been added to further recite patentable aspects of the invention. It is believed that no new matter has been introduced by these claims. Therefore, Applicants respectfully request entry of new claims 23 and 24.

Claim Rejections Under 35 U.S.C. §103

I. Rejection of Claims 1 & 3-8.

Claims 1, 3-7 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Dakshina-Murthy et al.* (U.S. 6,884,733) in view of *Godet*, Journal of Applied Physics, Vol. 84, 3919, (1998), and *Park et al.* (U.S. Pub. No. 2004/0224241). Claims 3 and 6 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Dakshina-Murthy et al.* in view of *Godet*, and *Park et al.*, in further view of *Yang et al.* (U.S. Pub. No. 2003/0003771).

The Examiner states that *Dakshina-Murthy et al.* fails to disclose a dual-frequency plasma for PECVD deposition. The Examiner states that *Godet* describes a process where a dual-frequency plasma is used for deposition of an amorphous carbon

layer using Ar-H_2 or Ar-He gas mixtures. The Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of *Dakshina-Murthy et al.* to use the dual-frequency method of *Godet* for forming the amorphous carbon layer because *Godet* teaches dual-frequency is conventionally used for amorphous carbon layer deposition. The Examiner further concludes that one of ordinary skill in the art would have been motivated to use a dual-frequency deposition method in order to obtain a high-quality dense deposit yielding a compact structure which is attributed to the increasing energy of the impinging ion during film growth. The Examiner further states that *Yang et al.* discloses a dual-frequency that includes a high frequency of 200 Watts at 13.56 MHz and a low frequency of 200 Watts and 500 KHz. The Examiner concludes that it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the process of *Dakshina-Murthy et al.* to use the frequencies and power levels as described above because *Yang et al.* illustrates the use of proven deposition conditions disclosed in the literature in order to obtain a reliable product while reducing costly process development time.

Applicants respectfully traverse this rejection based on the grounds that the Examiner has not established a case of prima facie obviousness. The Examiner bears the initial burden of establishing a *prima facie* case of obviousness. *See* MPEP § 2142. To establish a *prima facie* case of obviousness three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Third, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *See* MPEP § 2143. The present rejection fails to establish at least the third element.

Dakshina-Murthy et al. discloses depositing an amorphous carbon mask on a doped polysilicon material, and then depositing an anti-reflective cap layer on the amorphous carbon layer. Col. 3: lines 17-24. *Dakshina-Murthy et al.* discloses that the amorphous carbon layer is deposited in a PECVD chamber using a hydrocarbon atmosphere such as ethylene, propylene, methane, and the like. Col. 5: lines 46-48.

Dakshina-Murthy et al. further discloses that the PECVD process is performed with a plasma power of between approximately 800 and 1500 Watts. Col. 5: lines 50-53. *Dakshina-Murthy et al.* does not teach the use of dual frequency RF for depositing an amorphous carbon layer.

Godet discloses depositing hydrogenated amorphous carbon films in a dual-plasma reactor using butane as a carbon precursor and different mixtures (H_2-Ar or He-Ar) in the MW plasma in order to vary the atomic hydrogen flux impinging on the growing film. *See* abstract. *Godet* further discloses a dual-plasma (surface wave-coupled microwave MW at 2.45 GHz and capacitively coupled radio frequency rf at 13.56 MHz) reactor developed for the deposition of wide ban gap amorphous alloys at low substrate temperatures. *See* page 3920. *Godet* does not teach providing a first frequency between about 10 MHz and about 30 MHz at a power between 200 watts and 800 watts and a second frequency between about 100 KHz and about 500 KHz at a power between about 1 watt and about 200 watts.

Yang et al. discloses providing a thin layer of an adhesion promoter material, such as relatively hydrogen-free hydrogenated silicon carbon (SiC:H), between layers of silicon nitride (Si_3N_4) and an amorphous fluorocarbon (a-F:C) to enhance the adhesion and mechanical properties of the damascene structure. *See* U.S. Pat App. Pub. No. 2003/0003771 at [0001]. *Yang et al.* discloses depositing the fluorinated amorphous carbon (a-F:C) layer on a substrate by providing a fluorine containing gas, preferably octafluorocyclobutane, and a carbon containing gas, preferably methane. *See* U.S. Pat App. Pub. No. 2003/0003771 at [0016]. *Yang et al.* further discloses that the power supplied during this deposition step typically involves a dual frequency RF discharge. *See* U.S. Pat App. Pub. No. 2003/0003771 at [0040]. Thus, *Yang et al.* teaches the frequencies used when depositing an amorphous fluorocarbon on a dielectric layer using a dual frequency RF. Thus, *Yang et al.* fails to teach the formation of amorphous carbon using a dual frequency RF.

Park et al. discloses gate lines as well as a gate shorting bar including two films having different physical characteristics, a lower film and an upper film. *See* U.S. Pat. App. Pub. No. 2004/0224241 at [0069]. The upper film is preferably made of a low resistivity metal including Al containing metal such as Al and Al alloy for reducing signal

delay or voltage drop in the gate lines. *See* U.S. Pat. App. Pub. No. 2004/0224241 at [0069]. On the other hand, the lower film is preferably made of material such as Cr, Mo, Mo alloy, Ta and Ti, which has good physical, chemical, and electrical contact characteristics with other oxide materials such as indium tin oxide (ITO) and indium zinc oxide (IZO). *See* U.S. Pat. App. Pub. No. 2004/0224241 at [0069].

Dakshina-Murthy et al. in view of *Godet*, and *Park et al.*, in further view of *Yang et al.* either alone or in combination do not teach, show, motivate, or suggest a method for processing a substrate in a processing chamber, comprising, forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon layer on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y, wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual frequency RF source, wherein the dual-frequency RF source comprises providing a first frequency between about 10 MHz and about 30 MHz and a second frequency between about 100 KHz and about 500 KHz, etching the amorphous carbon layer to form a patterned amorphous carbon layer, and etching feature definitions in the conductive material layer corresponding to the patterned amorphous carbon layer as recited in independent claim 1 and claims 3-5 and 7-8 dependent thereon.

Thus Applicants submit that independent claim 1 and claims 3-5 and 7-8 depending thereon are patentable over *Dakshina-Murthy et al.* in view of Godet, and *Park,* in further view of *Yang et al.* either alone or in combination. Accordingly, Applicants respectfully request that the rejection be withdrawn and the claims be allowed.

II. Rejection of Claims 9 and 11-18.

Claims 9, 11-18 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Dakshina-Murthy et al.* in view of *Godet*, and *Park et al.* Claim 14 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Dakshina-Murthy et al.* in view of *Godet*, and *Park et al.*, in further view of *Yang et al.* Applicants respectfully traverse the rejection.

The arguments discussed above regarding *Dakshina-Murthy et al.* in view of *Godet*, and *Park et al.*, in further view of *Yang et al.* are equally applicable here as none of the references teach using dual frequency RF at the frequency ranges recited in claim 9 to deposit amorphous carbon.

Therefore, *Dakshina-Murthy et al.* in view of Godet, and *Park et al.,* in further view of *Yang et al.* either alone or in combination do not teach, show, motivate, or suggest a method for processing a substrate in a chamber, comprising, forming a conductive material layer on a surface of the substrate, depositing an amorphous carbon hardmask on the conductive material layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y, wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, wherein the dual-frequency RF source comprises providing a first frequency between about 10 MHz and about 30 MHz and a second frequency between about 100 KHz and about 500 KHz, depositing an anti-reflective coating on the amorphous carbon hardmask, depositing a patterned resist material on the anti-reflective coating and amorphous carbon hardmask to the conductive material layer, and etching feature definitions in the conductive material layer as recited in claim 9 and claims 9, 11-13, and 15-18 dependent thereon.

Thus Applicants submit that independent claim 9 and claims 11-13, and 15-18 depending therefrom are patentable over *Dakshina-Murthy et al.* in view of *Godet*, and *Park,* in further view of *Yang et al.*, either alone or in combination. Accordingly, Applicants respectfully request that the rejection be withdrawn and the claims be allowed.

III. Rejection of Claims 19-22.

Claim 19-22 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Dakshina-Murthy et al.* in view of *Godet*, and *Park et al.* Claim 22 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Dakshina-Murthy et al.* in view of *Godet*, and *Park et al.*, in further view of *Yang et al.* Applicants respectfully traverse the rejection.

The arguments discussed above regarding *Dakshina-Murthy et al.* in view of *Godet*, and *Park et al.*, in further view of *Yang et al.* are equally applicable here as none of the references teach using dual frequency RF at the frequency ranges recited in claim 19 to deposit amorphous carbon.

Therefore, *Dakshina-Murthy et al.* in view of *Godet*, and *Park et al.,* in further view of *Yang et al.* either alone or in combination do not teach, show, motivate, or suggest a method for processing a substrate in a chamber, comprising, forming an aluminum containing layer on a surface of the substrate, depositing an amorphous carbon hardmask on the aluminum containing layer by a method comprising introducing into the processing chamber one or more hydrocarbon compounds having the general formula C_xH_y, wherein x has a range of 2 to 4 and y has a range of 2 to 10, and generating a plasma of the one or more hydrocarbon compounds by applying power from a dual-frequency RF source, wherein the dual-frequency RF source comprises providing a first frequency between about 10 MHz and about 30 MHz at a power between 200 watts and 800 watts and a second frequency between about 100 KHz and about 500 KHz at a power between about 1 watt and about 200 watts, depositing an anti-reflective coating on the amorphous carbon hardmask, wherein the anti-reflective coating is a material selected from the group of silicon nitride, silicon carbide, carbon-doped silicon oxide, amorphous carbon, and combinations thereof, depositing a patterned resist material on the anti-reflective coating, etching the anti-reflective coating and amorphous carbon hardmask to the aluminum-containing layer, removing the resist material, etching feature definitions in the aluminum containing layer at an etch selectivity of amorphous carbon to the aluminum-containing layer at an etch selectivity of amorphous carbon to the aluminum-containing between about 1:3 and about 1:10, and removing the one or more amorphous carbon layers by exposing the one or more amorphous carbon layers to a plasma of a hydrogen-containing gas or an oxygen containing gas as recited in claim 19 and claims 20-21 dependent thereon.

Thus Applicants submit that independent claim 19 and claims 20-21 depending therefrom are patentable over *Dakshina-Murthy et al.* in view of *Godet*, and *Park,* in further view of *Yang et al.*, alone or in combination. Accordingly, Applicants respectfully request that the rejection be withdrawn and the claims be allowed.

New Claims 23 & 24

Applicants have added new claims 23 and 24 to claim additional aspects of the invention. Applicants submit that new claim 23 is patentable for the reasons discussed above with respect to independent claim 1. Applicants further submit that new claim 24 is patentable for the reasons discussed above with respect to independent claim 9. Applicants respectfully request entrance and allowance of new claims 23 and 24.

Conclusion

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show, or suggest the invention as claimed.

The secondary references made of record are noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, Applicants believe that a detailed discussion of the secondary references is not necessary for a full and complete response to this office action.

Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,

Keith M. Tackett
Registration No. 32,008
PATTERSON & SHERIDAN, L.L.P.
3040 Post Oak Blvd. Suite 1500
Houston, TX 77056
Telephone: (713) 623-4844
Facsimile: (713) 623-4846
Attorney for Applicant(s)